MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2016/2017

PMT0204 – FUNDAMENTAL MATHEMATICS II

(All sections / Groups)

01 JUNE 2017
2.30 p.m - 4.30 p.m
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question Paper consists of 4 pages with 4 Questions only.
2. Answer all **FOUR (4)** questions.
3. Write all your answers in the Answer Booklet provided.
4. Formula sheet is provided at the end of the Question Paper.

Question 1 (25 Marks)

a) Given matrix $A = \begin{bmatrix} 1 & 1 \\ 2 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 4 \\ 1 & 8 \end{bmatrix}$, find $3A + B^T$. **(4 marks)**

b) Given matrix $C = \begin{bmatrix} x & 2 \\ z & 6 \end{bmatrix}$ and $D = \begin{bmatrix} 3 & y \\ 2 & -1 \end{bmatrix}$.

If $(CD)^T = \begin{bmatrix} 1 & 9 \\ 8 & s \end{bmatrix}$, find x, y, z and s. **(9 marks)**

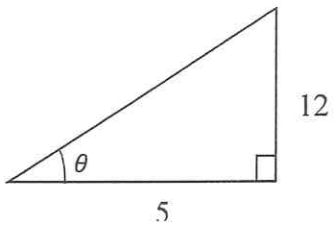
c) By using the inverse matrix, solve the following system of linear equations.

$$\begin{bmatrix} 2 & 0 & 8 \\ -1 & 4 & 0 \\ 2 & 1 & 0 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 8 \\ 36 \\ 9 \end{bmatrix}$$

(12 marks)

Question 2 (25 Marks)

a) Find the values of the six trigonometric functions of the angle θ for the following figure.



(7 marks)

b) Determine the amplitude, period, phase shift and vertical shift of the following function:

$$f(x) = 2\sin(4x - 2) + 3\,.$$ **(4 marks)**

c) Prove that $\sin y + \sin y \cot^2 y = \csc y$ **(4 marks)**

d) Solve the equation $\sin^2\theta - \sin\theta = 2$ **(6 marks)**

e) Write the complex number $z = -1 - \sqrt{3}i$ in trigonometric form. **(4 marks)**

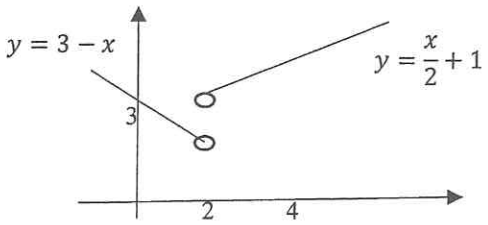
Question 3 (25 Marks)

a) Evaluate the following limits, if they exist:

i) $\lim_{x \to 4} 5x^3 + 2x^2 - 2$ **(2 marks)**

ii) $\lim_{x\to 1} \frac{x^2+x-2}{x^2-x}$ **(3 marks)**

b) Let $f(x) = \begin{cases} 3-x, & x<2 \\ \frac{x}{2}+1, & x>2 \end{cases}$



Find $\lim_{x\to 2^+} f(x)$, $\lim_{x\to 2^-} f(x)$ and $\lim_{x\to 2} f(x)$. **(5 marks)**

c) Differentiate the following functions with respect to x. Simplify the answer.

i) $y = (2x^3+\pi)^2$ **(3 marks)**

ii) $y = (2x-3)^4(4x+5)^6$ **(6 marks)**

iii) $y = 2\left(\frac{5x^3-2x+1}{2x^2+4}\right)$ **(6 marks)**

Question 4 (25 Marks)

a) Evaluate the following integrals:

i) $\int \frac{6x+7}{(x+2)^2}$ **(7 marks)**

ii) $\int_0^{\pi/4} \cos 2x\sqrt{1+\sin 2x}\, dx$ **(7 marks)**

b) Let R be the region bounded by the curves $y=-x$, $x=5$, and $y=0$.

i) Sketch the region R and label the intersection points with their respective coordinates. **(5 marks)**

ii) Use integration to find the area of the region R. **(6 marks)**

FORMULAE LIST

A. Trigonometric Identities

Pythagorean Identities

$\cos^2 A + \sin^2 A = 1$ $\quad \sec^2 A = 1 + \tan^2 A$ $\quad \csc^2 A = 1 + \cot^2 A$

Law of sines $\dfrac{\sin A}{a} = \dfrac{\sin B}{b} = \dfrac{\sin C}{c}$

Law of cosines

$$a^2 = b^2 + c^2 - 2ab\cos A$$
$$b^2 = a^2 + c^2 - 2ab\cos B$$
$$c^2 = a^2 + b^2 - 2ab\cos C$$

B. Differentiation Rules

Product-to-Sum Formulas

$\dfrac{d}{dx}[x^n] = nx^{n-1}$; n is any real number

$\dfrac{d}{dx}[f(x).g(x)] = f(x)g'(x) + f'(x)g(x)$; The Product Rule

$\dfrac{d}{dx}\left[\dfrac{f(x)}{g(x)}\right] = \dfrac{g(x)f'(x) - f(x)g'(x)}{[g(x)]^2}$; The Quotient Rule

$\dfrac{d}{dx}f(g(x) = f'(g(x)).g'(x)$; The Chain Rule

$\dfrac{d}{dx}[g(x)]^n = n[g(x)]^{n-1}.g'(x)$; The power rule combined with the chain rule

$\dfrac{d}{dx}[\sin x] = \cos x$ $\quad \dfrac{d}{dx}[\cos x] = -\sin x$ $\quad \dfrac{d}{dx}[\tan x] = \sec^2 x$

$\dfrac{d}{dx}[\sec x] = \sec x \tan x$ $\quad \dfrac{d}{dx}[\cot x] = -\csc^2 x$ $\quad \dfrac{d}{dx}[\csc x] = -\csc x \cot x$

$\dfrac{d}{dx}[e^x] = e^x$ $\quad \dfrac{d}{dx}[\ln x] = \dfrac{1}{x}; \quad x > 0$

C. Basic Integration Formulas

$\int cf(x)\,dx = c\int f(x)\,dx$ $\quad \int k.dx = kx + C$

$\int [f(x) \pm g(x)]dx = \int f(x)dx \pm \int g(x)dx$ $\quad \int x^n dx = \dfrac{x^{n+1}}{n+1} + C, \quad n \neq -1$

$\int e^x\,dx = e^x + C$ $\quad \int \dfrac{1}{x}dx = \ln|x| + C$

Integration by-parts: $\int u\,dv = uv - \int v\,du$

Volume (disk) $= \pi \int_a^b \left(f(x)\right)^2 dx$

Area $= \int_a^b \left(f(x) - g(x)\right) dx$

Volume (washer) $= \pi \int_a^b \left[\left(f(x)\right)^2 - \left(g(x)\right)^2\right] dx$

End of Page